"It's like they're speaking a different language …"
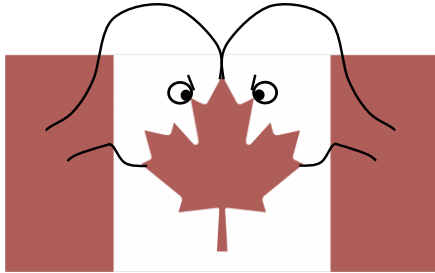
How research into second-language learning might be useful for improving mathematics teaching practice

Brent Davis | University of Calgary

The Context

- Halfway through a 7-year collaborative inquiry into "Changing the culture of mathematics teaching at the school level"

- Co-Researchers: Jo Towers, Olive Chapman, Sharon Friesen, Michelle Drefs

- Design-based research – a methodology in which participants attempt to understand the world by/while working to change it (Hoadley, 2004)

- Preliminary strategy (first 2.5 years): Infuse ideas into the system through a highly invested, self-selected core group

- Subsequent strategy: Reporting on that today.

Brent Davis | University of Calgary

How research into second-language learning might be useful for improving teaching practice

Agenda

- **Ecosystems of Analogy** – how humans think, and why some ideas seem so much more compelling than others

- Educational Paradigms – some of the conflicting "languages" that are part of the current educational landscape

- Language Competencies – examples of how educators can speak very different languages … even when it sounds like they're saying the same thing

- Changing Mindsets – how research into second-language learning might be useful for improving teaching practice.

WARM-UP EXERCISE 1: # What's teaching?

Identify a synonym for "teaching that really resonates with you.

WARM-UP EXERCISE 1: 150 synonyms of teaching

|					
admonishing	cultivating	feeding	implanting	listening	prompting
advising	culturing	fitting	impregnating	manuring	proselytizing
alerting	demonstrating	forming	impressing upon the mind	mastering	protecting
ameliorating	developing	fostering	impressing upon memory	mediating	putting up to
beating into	directing	framing	improving	mentoring	qualifying
bettering	directing attention to	giving a discourse	improving minds	minding	reading a lesson
brainwashing	disciplining	giving a lecture	improvising	modeling	readying
breaking	disseminating	giving a lesson	incepting	moralizing	rearing
breaking in	drawing in	giving a sermon	inculcating	nourishing	refining
breeding	drawing out	giving an idea	indoctrinating	nurturing	reforming
bringing forward	drilling	giving instruction	inducting	occasioning	remediating
bringing up	edifying	giving new ideas	infiltrating	opening eyes	schooling
caring	educating	giving the facts	infixing	participating	shaping
catechizing	emancipating	giving voice	influencing	pedagogy	sharpening
challenging	empowering	grafting	informing	persuading	sharpening wits
changing	enabling	grilling	infusing	perturbating	shepherding
coaching	encouraging	grounding	ingrafting	pointing out	showing
communicating	enculturating	guiding	initiating	polishing up	showing the ropes
conditioning	enlarging the mind	habituating	inoculating	pounding into	sowing seeds
conversing	enlightening	holding forth	instilling	practicing	structuring
converting	exercising	honing	instructing	preparing	taking in hand
convincing	explaining	illuminating	interpreting	priming	taming
correcting	expounding	illustrating	inuring	processing	telling
cramming	facilitating	imbuing	lecturing	prodding	training
	familiarizing with	imparting	liberating	professing	tutoring

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WARM-UP EXERCISE 2: Which side are you on?

In 2012, the Edmonton Public School Board suspended high school teacher Lynden Dorval for giving students zeros when they missed tests or didn't hand in assignments.
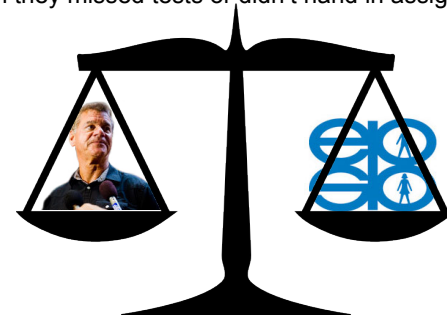
1) Which side would you support? Justify your position in <4 words.

2) You've just been hired to defend the other side in court. Justify that position.

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How did you argue?

Pro-Dorval

Pro-EPSB

- grades are earnings
- grades measure something
- grades motivate / are rewards/punishments
-
-
-
-

- grades are feedback on learning
- grades are reflections of underandings
-
-

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Which language did you use?

Pro-Dorval

Pro-EPSB

- grades are earnings

- grades are feedback on learning

Three points:

1. Such rationales/beliefs are based on metaphors/ analogies.
2. Specific metaphors are compelling and persistent because they exist in grander webs of association.
3. It's can be VERY difficult to identify one's metaphors, and even harder to get a sense of the grander web.
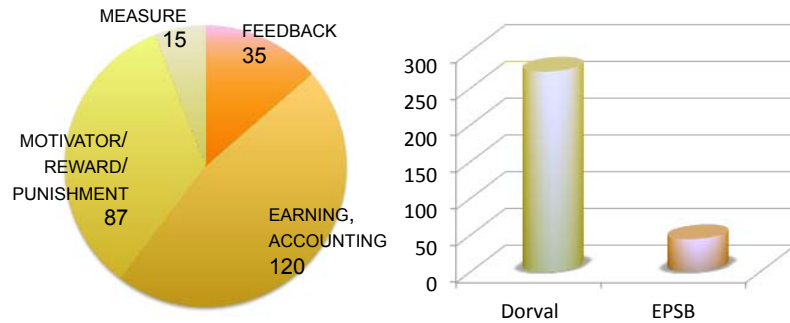
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Where 300+ pre-service teachers landed

In the case of Dorval vs. EPSB …

MEASURE 15
FEEDBACK 35
MOTIVATOR/ REWARD/ PUNISHMENT 87
EARNING, ACCOUNTING 120

(Pie chart)

(Bar chart with values 0–300, Dorval ~290, EPSB ~55)

(Notably, 50+ of the pro-Dorvalians couldn't identify their metaphor …
… which matters because it means they can't interrogate their convictions.)

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Point 1: The rationales are based on metaphors/analogies

Humans are **ANALOGICAL** creatures who are capable of (but not very good at) **LOGIC**.
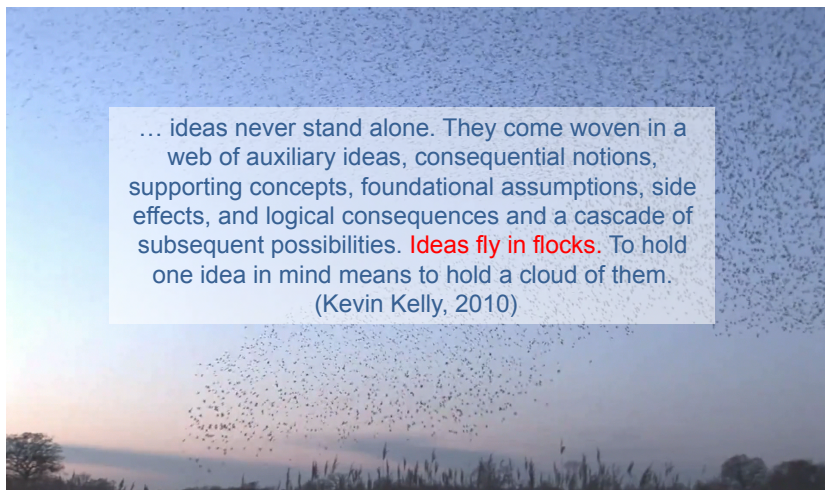
Human learning/knowing is most commonly defined in terms of **logical** & **sequential** processes.

It is coming to be understood as mostly a matter of **analogical** and **associative** processes.
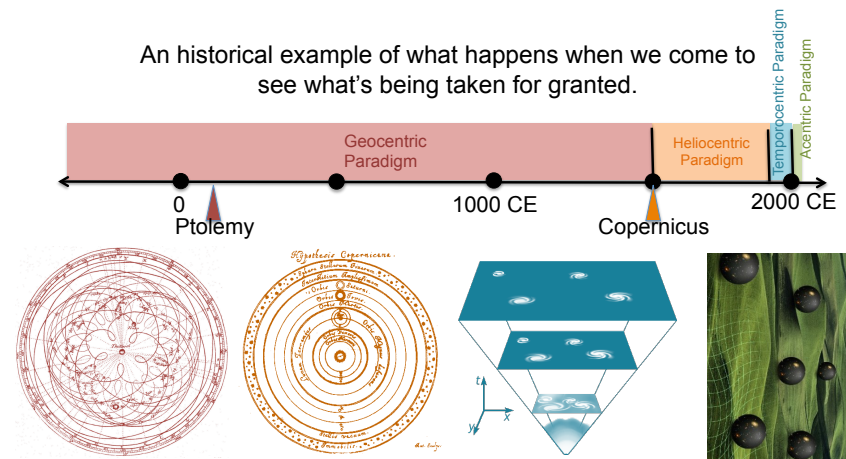
logical → linear, orderly, one-thing-at-a-time, standardizable

analogical → unruly, disorderly, multiple-things-at-once, idiosyncratic

For the most part, we think associatively through **images**, **metaphors**, **analogies**, and so on.

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Point 2: Metaphors exist in grander webs of association

… ideas never stand alone. They come woven in a web of auxiliary ideas, consequential notions, supporting concepts, foundational assumptions, side effects, and logical consequences and a cascade of subsequent possibilities. Ideas fly in flocks. To hold one idea in mind means to hold a cloud of them.
(Kevin Kelly, 2010)

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Point 3: Identifying metaphors and their webs is difficult.

An historical example of what happens when we come to see what's being taken for granted.

Geocentric Paradigm | Heliocentric Paradigm | Temporocentric Paradigm | Acentric Paradigm

0   Ptolemy   1000 CE   Copernicus   2000 CE

Re-emphasizing Point 2: These paradigms are/were compelling and resilient because they are part of grander (religious, political, philosophical, etc.) webs.

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Slide 1

Point 3: Identifying metaphors and their webs is difficult.

William Irwin Thompson's characterization of prevailing worldviews over the past 3000 years.

| Arithmetic | Geometric | Algebraic | Chaotic |

0 — 1000 CE — 2000 CE

counting; ordering

structuring; aestheticizing

objectifying; mastering

complexifying; complicifying

Re-emphasizing Point 2: These paradigms are/were compelling and resilient because they are part of grander (religious, political, philosophical, etc.) webs.
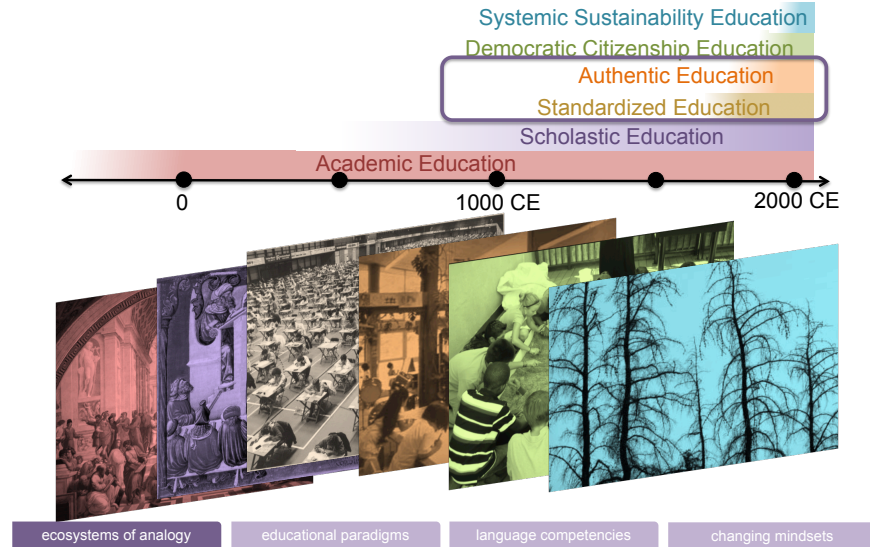
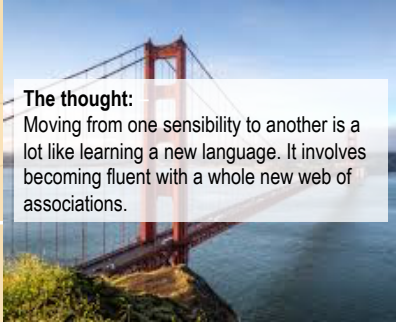| ecosystems of analogy | educational paradigms | language competencies | changing mindsets |

Slide 2

Some Paradigms in Western Formal Education

Systemic Sustainability Education
Democratic Citizenship Education
Authentic Education
Standardized Education
Scholastic Education
Academic Education

0 — 1000 CE — 2000 CE

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Slide 3

How research into second-language learning might be useful for improving teaching practice

Agenda

- Ecosystems of Analogy – how humans think, and why some ideas seem so much more compelling than others

- **Educational Paradigms** – some of the conflicting "languages" that are part of the current educational landscape

- Language Competencies – examples of how educators can speak very different languages … even when it sounds like they're saying the same thing

- Changing Mindsets – how research into second-language learning might be useful for improving teaching practice.
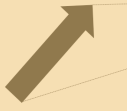
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Slide 4

	STANDARDIZED EDUCATION	← "TRADITIONALese"	"REFORMese" →	AUTHENTIC EDUCATION
PARADIGM	STANDARDIZED EDUCATION			AUTHENTIC EDUCATION
START	1600s			early 1900s
ATTITUDE	Physical Sciences	These "languages" are internally consistent,		Human Sciences
INFLUENCES	Physics & Industry			Biology & Structuralism
METAPHORS	MECHANICAL; DIRECTIONAL			ORGANIC; BRANCHING
ICONIC VISUAL METAPHOR		but mutually incoherent.		
KNOWLEDGE	OBJECTIFIED FACTS	(And each is also a subset of a grander cultural – philosophical, religious, political, pragmatic, mathematical, artistic, scientific, etc. – sensibility.)		PERSONAL INTERPRETATION
CURRICULUM	skills & computation			meaning & modeling
LEARNERS	FIXED, DEFICIENT CONTAINERS			EVOLVING, SUFFICIENT AGENTS
LEARNING	ACQUIRING; INTERNALIZING			CONSTRUING; EMBODYING
TEACHING	**INSTRUCTING; DELIVERING; DIRECTING** (EVALUATIVE LISTENING)			**OCCASIONING; CHALLENGING** (INTERPRETIVE LISTENING)

(Row labels at left: HISTORY AND CONTEXT spans ATTITUDE/INFLUENCES/METAPHORS/ICONIC VISUAL METAPHOR; EPISTEMOLOGY spans KNOWLEDGE/CURRICULUM/LEARNERS/LEARNING; PEDAGOGY spans TEACHING)

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Slide 1

	STANDARDIZED EDUCATION	← "TRADITIONALese" "REFORMese" →	AUTHENTIC EDUCATION
PARADIGM			
START	1600s		early 1900s
ATTITUDE	Physical Sciences		Human Sciences
INFLUENCES	Physics & Industry		Biology & Structuralism
METAPHORS	MECHANICAL; DIRECTIONAL		ORGANIC; BRANCHING
ICONIC VISUAL METAPHOR			

The thought:
Moving from one sensibility to another is a lot like learning a new language. It involves becoming fluent with a whole new web of associations.

	STANDARDIZED EDUCATION		AUTHENTIC EDUCATION
KNOWLEDGE	OBJECTIFIED FACTS		PERSONAL INTERPRETATION
CURRICULUM	skills & computation		meaning & modeling
LEARNERS	FIXED, DEFICIENT CONTAINERS		EVOLVING, SUFFICIENT AGENTS
LEARNING	ACQUIRING; INTERNALIZING		CONSTRUING; EMBODYING
TEACHING	**INSTRUCTING; DELIVERING; DIRECTING** (EVALUATIVE LISTENING)		**OCCASIONING; CHALLENGING** (INTERPRETIVE LISTENING)

(HISTORY AND CONTEXT / EPISTEMOLOGY / PEDAGOGY)

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Slide 2

MOMENT	STANDARDIZED EDUCATION	AUTHENTIC EDUCATION	DEMOCRATIC CITIZENSHIP EDUCATION	SYSTEM SUSTAINABILITY EDUCATION
START	1600s	early 1900s	1960s	1990s
ATTITUDE	Physical Sciences	Human Sciences	Social Sciences	Complexity Sciences
INFLUENCES	Physics & Industry	Biology & Structuralism	Sociology & Economics	Ecology & Systems Theory
METAPHORS	MECHANICAL; DIRECTIONAL	ORGANIC; BRANCHING	CONTRACTUAL; COLLABORATIVE	ECOSYSTEMIC; EMERGENT
ICONIC VISUAL METAPHOR				
KNOWLEDGE	OBJECTIFIED FACTS	PERSONAL INTERPRETATION	SOCIAL CONSTRUCTIONS	VIBRANT COMPLEX FORMS
CURRICULUM	mastery of skills & Canon	meaning & understanding	conscientized participation	wellness; awareness
LEARNERS	FIXED, DEFICIENT CONTAINERS	EVOLVING, SUFFICIENT AGENTS	PARTIAL AGENTS	COMPLEX UNITIES
LEARNING	ACQUIRING; TRAVERSING	CONSTRUING; EMBODYING	APPRENTICING; ACCULTURATING	MAINTAINING VIABILITY
TEACHING	**INSTRUCTING; DELIVERING; DIRECTING** (EVALUATIVE LISTENING)	**OCCASIONING; CHALLENGING** (INTERPRETIVE LISTENING)	**ENCULTURATING; EMPOWERING**	**DESIGNING; ENGAGING**

(HISTORY AND CONTEXT / EPISTEMOLOGY / PEDAGOGY)

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Slide 3

Agenda

How research into second-language learning might be useful for improving teaching practice

- Ecosystems of Analogy – how humans think, and why some ideas seem so much more compelling than others

- Educational Paradigms – some of the conflicting "languages" that are part of the current educational landscape

- **Language Competencies – examples of how educators can speak very different languages … even when it sounds like they're saying the same thing**

- Changing Mindsets – how research into second-language learning might be useful for improving teaching practice.

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Slide 4

	STANDARDIZED EDUCATION	← "TRADITIONALese"
PARADIGM		
START	1600s	
ATTITUDE	Physical Sciences	
INFLUENCES	Physics & Industry	
METAPHORS	MECHANICAL; DIRECTIONAL	
ICONIC VISUAL METAPHOR		
KNOWLEDGE	OBJECTIFIED FACTS	
CURRICULUM	skills & computation	
LEARNERS	FIXED, DEFICIENT CONTAINERS	
LEARNING	ACQUIRING; INTERNALIZING	
TEACHING	**INSTRUCTING; DELIVERING; DIRECTING** (EVALUATIVE LISTENING)	

(HISTORY AND CONTEXT / EPISTEMOLOGY / PEDAGOGY)

SOME SNIPPETS FROM STAN

Metaphor	Sample Usages
knowledge as [CONSTRUCTABLE OR DISCOVERABLE] FIXED OBJECT	"… a math concept is the solution to a pattern, equation or problem and how these solutions are derived …" "… the meaning behind a concept and … why certain steps are taken to solve a problem …"
learning as ACQUISITION	"… they only had to pick up one rule a day …" "… get a good understanding of the rules and the reason behind the rules …" "… have them "practice" these steps over and over so the outcomes become automatic …"
teaching as DELIVERY OF KNOWLEDGE OBJECTS	"… Simply show students a clear step-by-step process to follow …" "… quick to tell them the trick or the formula …" "… when I taught students to solve algebraic equations, I would identify the operation and teach students to do the opposite …"

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Panel 1 (top-left)

PARADIGM	AUTHENTIC EDUCATION	← "**REFORMese**"
START	early 1900s	
ATTITUDE	Human Sciences	
INFLUENCES	Biology & Structuralism	
METAPHORS	ORGANIC; BRANCHING	
ICONIC VISUAL METAPHOR		
KNOWLEDGE	PERSONAL INTERPRETATION	
CURRICULUM	meaning & modeling	
LEARNERS	EVOLVING, SUFFICIENT AGENTS	
LEARNING	CONSTRUING; EMBODYING	
TEACHING	**OCCASIONING; CHALLENGING** (INTERPRETIVE LISTENING)	

(left margin labels: HISTORY AND CONTEXT, EPISTEMOLOGY, PEDAGOGY)

SOME SNIPPETS FROM ARTHUR

General Metaphor	Specific Metaphors	Sample Usages
knowledge as DYNAMIC WEB OF ASSOCIATIONS	RELATIONSHIP	"Mathematics is the study of relationships between our world and the observations we make."
	SITUATED CONCEPTS	"… how understanding can be different and complex depending on the context in which a concept is examined."
learning as CONSTRUING COHERENCE	CONNECTING	"… how math relates to the world around us … concepts connect to other things … apply in different situations …"
	PERSONALIZING	"… each different person sees a different pattern and interpret … develop their understandings … and create their own ideas"
	EVOLVING; ADAPTING	"… constantly adjust what they are doing to fit … able to apply a variety of strategies … adapt it to their personal strengths …"
teaching as DESIGNING SETTINGS TO SUPPORT SENSE-MAKING	ENGAGING	"… actively engage students while keeping them on task and challenged … provide opportunities to learn in different ways …"
	CHALLENGING	"… promote mathematical reasoning … see [math] as interesting, challenging, relevant … maximize use of problem solving …"
	AFFORDING	"… allow students to reason and find their own justification … let them increase personal connections and examples …"

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Panel 2 (top-right)

"**TRADITIONALese**" "**REFORMese**"

Observations:

Standardized Stan
- unable to speak directly/explicitly to beliefs about learning and knowledge
- very limited lexicon for teaching

Authentic Arthur
- able to summon multiple, nuanced descriptions of knowledge, learning, and teaching

STAN		ARTHUR	
Metaphor		**General Metaphor**	**Specific Metaphors**
knowledge as [CONSTRUCTABLE OR DISCOVERABLE] FIXED OBJECT		knowledge as DYNAMIC WEB OF ASSOCIATIONS	RELATIONSHIP
			SITUATED CONCEPTS
learning as ACQUISITION		learning as CONSTRUING COHERENCE	CONNECTING
			PERSONALIZING
			EVOLVING; ADAPTING
teaching as DELIVERY OF KNOWLEDGE OBJECTS		teaching as DESIGNING SETTINGS TO SUPPORT SENSE-MAKING	ENGAGING
			CHALLENGING
			AFFORDING

For both:

Teaching that is highly consistent with their flocks of associations.

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Panel 3 (bottom-left)

PARADIGM	STANDARDIZED EDUCATION	← "**TRADITIONALese**" "**REFORMese**" →	AUTHENTIC EDUCATION
START	1600s		early 1900s
ATTITUDE	Physical Sciences		Human Sciences
INFLUENCES	Physics & Industry		Biology & Structuralism
METAPHORS	MECHANICAL; DIRECTIONAL		ORGANIC; BRANCHING
ICONIC VISUAL METAPHOR			
KNOWLEDGE	OBJECTIFIED FACTS		PERSONAL INTERPRETATION
CURRICULUM	skills & computation		meaning & modeling
LEARNERS	FIXED, DEFICIENT CONTAINERS		EVOLVING, SUFFICIENT AGENTS
LEARNING	ACQUIRING; INTERNALIZING		CONSTRUING; EMBODYING
TEACHING	**INSTRUCTING; DELIVERING; DIRECTING** (EVALUATIVE LISTENING)		**OCCASIONING; CHALLENGING** (INTERPRETIVE LISTENING)

We've noticed a few monolingual Standardized Education Speakers

And and few strongly fluent Authentic Education speakers.

But the vast majority of teachers we interview seem to be "between languages."

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Panel 4 (bottom-right)

PARADIGM	STANDARDIZED EDUCATION		AUTHENTIC EDUCATION
START	1600s		early 1900s
ATTITUDE	Physical Sciences		Human Sciences
INFLUENCES	Physics & Industry		Biology & Structuralism
METAPHORS	MECHANICAL; DIRECTIONAL		ORGANIC; BRANCHING
ICONIC VISUAL METAPHOR			
KNOWLEDGE	OBJECTIFIED FACTS		PERSONAL INTERPRETATION
CURRICULUM	skills & computation		meaning & modeling
LEARNERS	FIXED, DEFICIENT CONTAINERS		EVOLVING, SUFFICIENT AGENTS
LEARNING	ACQUIRING; INTERNALIZING		CONSTRUING; EMBODYING
TEACHING	**INSTRUCTING; DELIVERING; DIRECTING** (EVALUATIVE LISTENING)		**OCCASIONING; CHALLENGING** (INTERPRETIVE LISTENING)

ONE COMMON WAY TO BE BETWEEN LANGUAGES

Pidgin – when two or more speakers who do not speak a common language form a distinct intermediate language

… which is kinda sorta comprehensible to all involved.

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Slide 1

	STANDARDIZED EDUCATION	"middle language"	AUTHENTIC EDUCATION
PARADIGM			
START	1600s	1970s-ish	early 1900s
HISTORY AND CONTEXT — ATTITUDE	Physical Sciences		Human Sciences
INFLUENCES	Physics & Industry		Biology & Structuralism
METAPHORS	MECHANICAL; DIRECTIONAL	EXPLORATION; DISCOVERY	ORGANIC; BRANCHING
ICONIC VISUAL METAPHOR			
EPISTEMOLOGY — KNOWLEDGE	OBJECTIFIED FACTS	TERRITORIES; MAPS; HIDDEN TREASURES	PERSONAL INTERPRETATION
CURRICULUM	skills & computation		meaning & modeling
LEARNERS	FIXED, DEFICIENT CONTAINERS	NAVIGATING; EXPLORING FINDING	EVOLVING, SUFFICIENT AGENTS
LEARNING	ACQUIRING; INTERNALIZING		CONSTRUING; EMBODYING
PEDAGOGY — TEACHING	INSTRUCTING; DELIVERING; DIRECTING (EVALUATIVE LISTENING)	FACILITATING; GUIDING; ORIENTING	OCCASIONING; CHALLENGING (INTERPRETIVE LISTENING)

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Slide 2

"middle language"
1970s-ish
EXPLORATION; DISCOVERY
TERRITORIES; MAPS; HIDDEN TREASURES
NAVIGATING; EXPLORING FINDING
FACILITATING; GUIDING; ORIENTING

SOME SNIPPETS FROM MIDDLETON

Metaphor	Sample Usages
knowledge as NAVIGABLE TERRITORY	"… to 'know' it means … that you can … navigate it …" "A math concept is like a map; there are many paths and many destinations along the way. … why certain steps are taken to solve a problem …"
learning as NAVIGATING & EXPLORING	… so it's not so much about *getting it* as *getting there* … … to feel a tangible sense of curiosity and exploration … … there are divergent ways to arrive at things …"
teaching as FACILITATING, GUIDING, & OFFERING TRAVEL ASSISTANCE	"… as they go through the question, they're going to encounter places where they need more instruction. And that's where we'll embed the instruction. So it's necessary, it's relevant at that moment." "**I liken it to like facilitation. You know. As opposed to teaching as much.**"

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Slide 3

"**TRADITIONALese**" "**MIDDLish**"   "**REFORMese**"

STAN	MIDDLETON	ARTHUR	
Metaphor	Metaphor	General Metaphor	Specific Metaphors
knowledge as [CONSTRUCTABLE OR DISCOVERABLE] FIXED OBJECT	knowledge as NAVIGABLE TERRITORY	knowledge as DYNAMIC WEB OF ASSOCIATIONS	RELATIONSHIP / SITUATED CONCEPTS
learning as ACQUISITION	learning as NAVIGATING & EXPLORING	learning as CONSTRUING COHERENCE	CONNECTING / PERSONALIZING / EVOLVING; ADAPTING
teaching as DELIVERY OF KNOWLEDGE OBJECTS	teaching as FACILITATING, GUIDING, & OFFERING TRAVEL ASSISTANCE	teaching as DESIGNING SETTINGS TO SUPPORT SENSE-MAKING	ENGAGING / CHALLENGING / AFFORDING

Why is this a problem?

1) The "language" of Middlish isn't sufficient to move sensibilities in ways that affect classroom practice in coherent and sustainable ways.

2) Middlish permits a sort of waffling that can feel progressive, but that may be regressive.

3) Middlish is an easy target for back-to-basics advocates, as it can be readily assumed by unilingual Traditionalese speakers (i.e. MOST people).
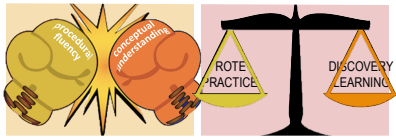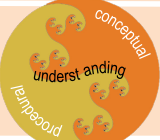
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Slide 4

1) Middlish isn't sufficient to move sensibilities in ways that affect classroom practice in coherent and sustainable ways.

"**TRADITIONALese**"	"**MIDDLish**"	"**REFORMese**"
STAN	MIDDLETON	ARTHUR
Teaching that is highly consistent with his flock of associations.	Teaching practices are a little schizophrenic.	Teaching that is highly consistent with his flock of associations.
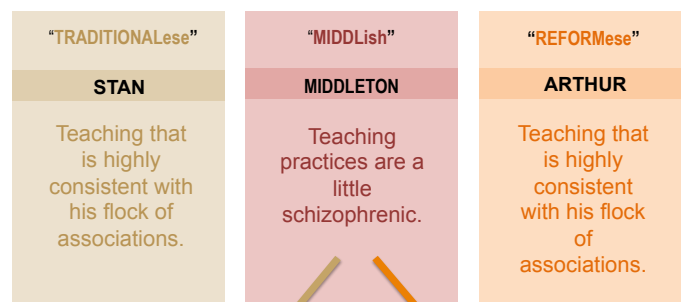
"… as they go through the question, they're going to encounter places where they need more instruction. And that's where we'll embed the instruction."

"I now throw in non-routine problems. It's important for them to see that it's not all step-by-step."

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2) Middlish permits a sort of waffling that can feel progressive, but that may be regressive.

LANGUAGE	TRADITIONALese	MIDDLish		REFORMese
"SPATIAL REASONING"	"something _more_" (in any already-packed curriculum)	"something _for_" (more efficiently get wherever one is going)		"something _in_" (an integral aspect of mathematical doing)
"MATH WARS"			Bottom line: In this school, Middlish is usually MUCH more closely affiliated with Traditional sensibilities than Reform sensibilities.	
"GROUP WORK"	Pod seating – i.e., seated in groups for individual work.	Cooperating.		Thinking out loud together; challenging on another
"PROBLEM SOLVING"	"application of skills"; "opportunities to practice" (mainly computational)	"opportunity to build enjoyment and self-confidence"		"part of mathematical modeling … living the math"
"PCK"	"I need to know more than they [the students] do."	willingness to "muddle through" together		"being able to get inside concepts, and knowing how they hang together"

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3) Middlish is an easy target for back-to-basics advocates, as it can be readily assumed by uniligual Traditionalese speakers (i.e. MOST people).

MIDDLish

change.org
Back to Basics: Mastering the fundamentals of mathematics
(A petition to the Alberta Minister of Education)
Nhung Tran-Davies

"The **Back to Basics: Mastering the Fundamentals of Mathematics** petition was started in December 2013 in response to clear evidence that since the introduction of the "new math" (discovery math) curriculum in the past decade, not only are we seeing deteriorating math scores across Canada, as measured by the OECD, but also its detrimental effects on our children's confidence, skills and future."

EXPLORATION; DISCOVERY

TERRITORIES; MAPS; HIDDEN TREASURES

NAVIGATING; EXPLORING FINDING

FACILITATING; GUIDING; ORIENTING

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How research into second-language learning might be useful for improving teaching practice

Agenda

- Ecosystems of Analogy – how humans think, and why some ideas seem so much more compelling than others

- Educational Paradigms – some of the conflicting "languages" that are part of the current educational landscape

- Language Competencies – examples of how educators can speak very different languages … even when it sounds like they're saying the same thing

- Changing Mindsets – how research into second-language learning might be useful for improving teaching practice.

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	PARADIGM	STANDARDIZED EDUCATION	"middle language"	AUTHENTIC EDUCATION
	START	1600s		early 1900s
HISTORY AND CONTEXT	ATTITUDE	Physical Sciences		Human Sciences
	INFLUENCES	Physics & Industry		Biology & Structuralism
	METAPHORS	MECHANICAL; DIRECTIONAL		ORGANIC; BRANCHING
	ICONIC VISUAL METAPHOR			
EPISTEMOLOGY	KNOWLEDGE	OBJECTIFIED FACTS		PERSONAL INTERPRETATION
	CURRICULUM	skills & computation		meaning & modeling
	LEARNERS	FIXED, DEFICIENT CONTAINERS		EVOLVING, SUFFICIENT AGENTS
	LEARNING	ACQUIRING; INTERNALIZING	FINDING	CONSTRUING; EMBODYING
PEDAGOGY	TEACHING	**INSTRUCTING; DELIVERING; DIRECTING** (EVALUATIVE LISTENING)	**FACILITATING; GUIDING; ORIENTING**	**OCCASIONING; CHALLENGING** (INTERPRETIVE LISTENING)

Does your synonym for teaching fall in one of these columns?

BIG QUESTION: How might we avoid a middle language while learning the new language?

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Lessons from research into second language learning

- Dwell in an immersive setting – with, e.g.,
  - routines & regular demands – practice, practice, practice
  - unpredictable challenges
  - peer support – corrections, challenges, elaborations

- Develop metacognitive awareness – by, e.g.,
  - explicitly discussing vocabulary
  - being attentive to how the new language carries a different worldview

- Engage in the challenge of bringing others into the language
  - speak in a way that confronts them with the limitations of their fluency
  - i.e., avoid a middle language

- Time
  - 2 years to "conversational fluency" (likely already achieved)
  - 5 years to "academic fluency"

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Our next DBR iteration …

- Designing an action research project within the DBR project
  - Mid-February – met with teaching leaders (a.k.a. administrators) to think through shared next steps
  - End of February (last week) – presented a scaled-down version of this talk to the math teachers in the school
  - Currently – doing a "what's holding us back" assessment
  - Balance of this school year – co-imagining a project among teachers of creating "an immersive setting" for next year
  - Next year – involving students and parents in a collective "change the language" project

- Immediate points of agreed emphasis/need
  - Weekly provocation to interrogate assumptions – à la "Dorval vs. EPSB" (next topic: Should we have an honor roll?)
  - PCK support – "We need better math to do this."
  - Using spatial reasoning as a focal element

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Why spatial reasoning?

Spatial reasoning is a **high-impact topic** –
- **strongly** predicts interest in, appreciation of, and success in STEM domains and careers
- correlates to academic success across **all** school disciplines

Spatial reasoning comprises a **high-yield skill set** –
- strong transferability across skills and disciplines
- highly malleable; it can be learned

Spatial reasoning is **under-used & under-developed** –
- ignored in current grade-school curriculum and teaching
- … which may contribute to atrophy

Spatial reasoning has **powerful disruptive possibilities** for Standardese and Middlish speakers
- It rests on a body of (Standardese-ish) evidence
- It resides in a Reform-ese ecosystem of associations

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Tag-onto-the-end thoughts

- The second-language-learning frame is proving a potent means remind ourselves of the complexity of educational change.

- Might it be a productive frame for construing/constructing/examining teacher education and professional development programs? (And might something like that already be happening somewhere?)

- And a dollop of reality:
  - PERHAPS more than any other profession, teaching happens in the vernacular.
  - No educational language can be better fitted than Standardized Education to the contemporary culture of objectification and commodification. To survive in this discursively hostile milieu, the language of Authentic Education must be deliberately distinct.

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